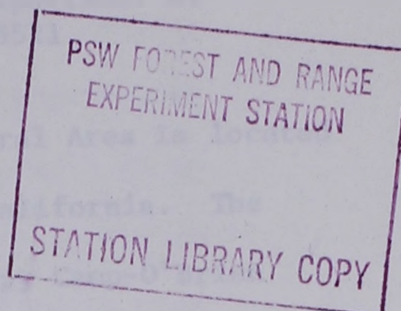


AN ECOLOGICAL SURVEY OF THE PROPOSED INDIAN CREEK BREWER SPRUCE
RESEARCH NATURAL AREA, SISKIYOU COUNTY, CALIFORNIA ¹



by

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Forest Service

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The proposed Indian Creek Brewer Spruce Natural Area is located approximately 15 miles northwest of Happy Camp, California. The stand of Picea breweriana is dissected by the Happy Camp-O'Brien Road and is limited to about 80 acres at the headwaters of the North Fork of Indian Creek (Figure 1). The proposed RNA lies in Section 4, T19N R5E on northeast-facing slopes at elevations between 4200 and 5000'. Natural boundaries are formed by the North Fork of Indian Creek, the ridge separating Louse Creek drainage from the Indian Creek drainage, and by the ridgeline to Little Grayback (elev. 6777'), a conspicuous local landmark. The area is now marked as a Brewer Spruce Management Area by the Klamath National Forest.

The underlying bedrock of pre-Cretaceous metasediments is typical of much of the Siskiyou Mountains. Slopes range from moderate to steep with a uniformly northeast aspect. Soils show moderate development. They appear to be internally well-drained.

Climatic data for the proposed RNA must be extrapolated from data collected at Happy Camp. Allowances must be made for elevational differences. The mean annual precipitation at the Happy Camp Ranger Station (elev. 900') over the last 10 years has been 57.5". The mean maximum and minimum temperatures for January

and July for the past 10 years have been 46.8°F and 30.2°F, and 96.0°F and 53.0° F respectively. Allowing for a 3°F drop in temperature for each 1000' elevation rise gives the following estimates for the proposed RNA: 36.8°F and 20.2°F in January and 86°F and 43°F in July. In addition to lower temperatures an increase in total precipitation is expected, as well as an increase in that portion which falls as snow. Even in dry years (example: April 1977) spring snow packs were drifted to over 4'. The precipitation totals and relatively moderate temperatures reflect a strong maritime influence in the western Klamath Mountains.

Methods

A preliminary reconnaissance was made in May 1977, at which time an inventory of vascular plants was initiated. The floristic survey was continued in June 1977, July and August 1978. Only plants of unknown taxa were collected. These were identified at the Humboldt State University Herbarium (HSC). Voucher specimens are deposited there. The initial reconnaissance suggested a single forest for the area. Sampling procedures were planned accordingly.

Determination of forest composition

Sampling for species composition of the canopy, understory and ground layers was accomplished by 20 relevés. In representative areas species coverage was estimated using standard techniques

(Mueller-Dombois and Ellenberg 1974). Association tables were then developed to check for possible compositional differences among samples.

Stand analyses

The forest was sampled for tree (> 4"dbh) density and basal area by the point-centered quarter method (Mueller-Dombois and Ellenberg 1974). Distances were estimated using a rangefinder, and diameters were taped. Within the stand 30 points were taken along transects which contoured slopes. Points were taken at 25-30 pace intervals depending upon stand density.

Growth rates were calculated for Picea breweriana, Abies concolor, A. procera, Pinus lambertiana and Pseudotsuga menziesii. Care was taken to only core vigorously growing canopy trees. The rates (years inch⁻¹) were calculated from samples averaging 5" in length.

Results

Some 99 taxa were recognized in the proposed RNA (Appendix I). The plants are typical of mid-elevation western Klamath Region flora. Several rare and endangered plants (Bensoniella oregana, Pedicularis howellii, Vaccinium coccinium) were found to grow here (Powell 1974).

Forest composition

The 20 relevés were assembled into a series of association tables to determine compositional differences. This analysis suggested that only minor differences existed between mid-slope and upper slope/ridge plots. The final presence table (Table 1) illustrates the differences in two phases of a single Picea breweriana/Quercus sadleriana forest. The mid-slope, Achlys triphylla phase is richer in herbaceous species, and is more heavily dominated by Vaccinium coccinium and Picea breweriana than is the drier Arctostaphylos patula phase.

The forest is dominated by Picea breweriana and Abies concolor. Secondary associates in the canopy are Abies procera, Pseudotsuga menziesii and Pinus lambertiana. Tree reproduction is mainly Picea and A. concolor, but with consistent amounts of A. procera and Pseudotsuga.

The rather open canopy of clumped trees allows for the strong development of an extensive shrub layer dominated by Quercus sadleriana and Vaccinium coccinium. Acer glabrum, Paxistima myrsinites, Salix scouleriana are common associates among a mix of some 19 shrub taxa (Table 1).

The ground layer varies in degree of development, with Rubus lasiococcus, Chimaphila umbellata, Pyrola picta, P. secunda being common and ubiquitous to the type.

Slope differences, as they affect available moisture and through its composition, are well reflected in understory composition. As is typical of Klamath montane forests (Sawyer and Thornburgh 1977) the more moist mid-slopes are relatively more herb-rich (Table 1). In this Achlys triphylla phase Linnaea borealis, Anemone deltoidea, Vancouveria hexandra, Clintonia uniflora, Achlys triphylla combine with the more ubiquitous Rubus lasoicoccus, Chimaphila spp., and Pyrola spp. Sorbus californica and more abundant Vaccinium coccinium are typical of these mesic slopes. Picea breweriana dominates over Abies spp. as well.

On the driest forest sites Chimaphila umbellata and Pyrola secunda remain in the Arctostaphylos patula phase. Prunus emarginata, Ceanothus velutinus are scattered, along with Arctostaphylos spp. and the always abundant Quercus sadleriana. Picea breweriana loses its dominance to Abies concolor in this drier phase.

Rock outcrops occupy small areas on upper slopes near ridges in the proposed RNA. Here Quercus garryana var. breweri, Arctostaphylos nevadensis, Amelanchier alnifolia, Penstemon newberryi and Sedum obtusatum are common.

An old clear-cut block is located to the south of the Brewer Spruce Management Area. Picea breweriana seedlings are scattered

among the shrubs of mainly Arctostaphylos patula and Quercus sadleriana. Penstemon anguineus, Nothochelone nemorsa and Chimaphila umbellata are common herbs here.

Stand analyses

Data from the point centered quarter method samples were used to calculate stand density and basal area (Table 2) for the Picea breweriana/Quercus sadleriana forest type. Most samples were taken at mid-slope locations, so data may better reflect Achlys phase sites. Picea breweriana and Abies concolor are most abundant; Pseudotsuga menziesii and Pinus lambertiana trees are few but large. Low density and basal area values for the forest as a whole reflect the open nature of the stand.

Productivity estimates were made by counting the number of annual rings per inch from core samples taken from vigorously growing canopy trees. Abies concolor and Picea breweriana were sampled more completely (Table 3). The slower growth of Picea breweriana is evident, especially in comparison to Abies spp.

Summary

The forests of the proposed Indian Creek Brewer Spruce Research Natural Area can be placed in the Abies magnifica zone of the western Klamath Region. They can be classified as representing the Picea breweriana/Quercus sadleriana type. Two phases of this type may be distinguished; a mesic, herb-rich Achlys triphylla phase, and a more

xeric Arctostaphylos patula phase. Stand density and basal area are low in these open forests. Tree reproduction suggests continuation of present composition. Three sensitive species have been identified in the area. One of these, Vaccinium coccinium, is a common understory shrub.

Evaluation of the area

In comparison to stands of Picea breweriana seen in the Klamath Region I (Sawyer) would rank this as one of the best. Those at Bear Basin Butte are equally outstanding, though spruce trees there do not dominate as they do here. Dale Thornburgh and I have long recommended the Klamath National Forest special status for the Indian Creek area. At least part of the proposed RNA is locally designated as a "special management area." The dominance and vigor of the spruce trees make this stand an excellent RNA candidate. Accessibility to the stand could not be better, and the old road and clearcut to the south make access to the upper slopes rather easy. One traditional detractant, the dust from the Happy Camp-O'Brien Road, is no longer a problem as the road is paved.

Recent cutting to the south defines that boundary; otherwise topographic boundaries are suggested (Figure 1). The proposed area includes the old clearcut which now adds some variability to the vegetation and different conditions to study spruce regeneration.

The presence of three sensitive species, along with the excellent Picea breweriana stands, argue for special management status for the area. Dale Thornburgh and I have been wandering around the Klamath Mountains of California for over 10 years looking at Brewer spruce stands. This was one of the first seen, and the more I look elsewhere the better this one looks. It is large, with a vigorous well-reproducing population readily available for scientific research. The strongest of recommendations are given for the establishment of an Indian Creek Brewer Spruce Research Natural Area.

Literature Cited

- Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. Wiley, New York. 547 p.
- Powell, W. R. 1974. Inventory of rare and endangered vascular plants of California. Spec. Publ. No. 1, Calif. Native Plant Soc. 56 p.
- Sawyer, J. O. and D. A. Thornburgh. 1977. Montane and sub-alpine vegetation of the Klamath Mountains. In: M. G. Barbour and J. Major (eds.) Terrestrial vegetation of California. Wiley, New York. 1000 p.

Table 1. Presence (P%) and modal cover/abundance (C/A) for all sampled trees, shrubs and herbs in the Picea breweriana/Quercus sadleriana type. The two phases were each sampled with 10 relevés. Cover/abundance scale: 1 = one individual, 2 = rare and < 10%, 3 = common and < 10%, 4 = 10-25%, 5 = 25-50%, 6 = 50-75%, 7 = > 75%. Applicable subspecific nomenclature in Appendix I.

Phase	<u>Achlys</u>		<u>Arctostaphylos</u>	
	P%	C/A	P%	C/A
Trees, upper canopy				
<u>Picea breweriana</u>	100	4	70	3
<u>Abies concolor</u>	100	3	100	4
<u>Abies procera</u>	70	2	80	3
<u>Pseudotsuga menziesii</u>	90	3	100	3
<u>Pinus lambertiana</u>	20	2	60	2
<u>Calocedrus decurrens</u>			10	1
Understory, or lower canopy				
<u>Picea breweriana</u>	100	4	80	2
<u>Abies concolor</u>	100	4	100	4
<u>Abies procera</u>	100	2	100	3
<u>Pseudotsuga menziesii</u>	50	3	80	3
Seedlings				
<u>Picea breweriana</u>	90	3	50	2
<u>Abies concolor</u>	90	2	100	3
<u>Abies procera</u>	40	2	60	2
<u>Pseudotsuga menziesii</u>			20	2
Shrubs				
<u>Ribes sanguineum</u>	10	1		
<u>Taxus brevifolia</u>	10	2		
<u>Sorbus californica</u>	40	2		
<u>Corylus cornuta</u>	20	2		
<u>Cornus stolonifera</u>	10	1		
<u>Rosa gymnocarpa</u>	20	3	20	2
<u>Acer glabrum</u>	40	3	10	2
<u>Vaccinium coccinium</u>	100	5	60	3
<u>Paxistima myrsinites</u>	50	3	30	3

Table 1. Continued

Phase	Achlys		Arctostaphylos	
	P%	C/A	P%	C/A
Shrubs (cont.)				
<u>Symphoricarpos hesperius</u>	10	2	20	2
<u>Quercus sadleriana</u>	100	5	100	6
<u>Mahonia nervosa</u>	10	2	20	2
<u>Amelanchier alnifolia</u>	10	2	20	4
<u>Salix scouleriana</u>	10	2	50	2
<u>Arctostaphylos patula</u>			70	2
<u>Garrya fremontii</u>			10	1
<u>Prunus emarginata</u>			10	2
<u>Ceanothus velutinus</u>			20	2
<u>Arctostaphylos nevadensis</u>			10	3
Herbs				
<u>Linnaea borealis</u>	50	3		
<u>Fragaria californica</u>	10	2		
<u>Anemone deltoidea</u>	40	2		
<u>Rubus macropetalus</u>	10	1		
<u>Galium triflorum</u>	30	2		
<u>Vancouveria hexandra</u>	40	2		
<u>Pedicularis racemosa</u>	10	3		
<u>Trientalis latifolia</u>	10	2		
<u>Polystichum imbricans</u>	10	2		
<u>Disporum hookeri</u>	10	1		
<u>Clintonia uniflora</u>	50	2		
<u>Trillium ovatum</u>	10	2	10	1
<u>Achlys triphylla</u>	70	3	10	2
<u>Goodyera oblongifolia</u>	40	2	20	2
<u>Rubus lasiococcus</u>	60	3	50	3
<u>Nothochelone nemorosa</u>	60	2	30	1
<u>Chimaphila umbellata</u>	100	3	100	3
<u>Pyrola secunda</u>	100	2	100	3
<u>Pyrola picta</u>	70	2	60	2
<u>Chimaphila menziesii</u>	40	2	50	2
<u>Penstemon anguineus</u>	10	2	10	2
<u>Lonicera ciliosa</u>			10	2
<u>Hydrophyllum occidentale</u>			10	1
<u>Lilium washingtonianum</u>			10	1

Table 2. Density (D as trees acre⁻¹) and basal area (BA as ft.² acre⁻¹) for the Picea breweriana/Quercus sadleriana type.

Species	D	BA
<u>Abies concolor</u>	29	22.9
<u>Picea breweriana</u>	35	55.1
<u>Pseudotsuga menziesii</u>	4	62.1
<u>Abies procera</u>	20	22.6
<u>Pinus lambertiana</u>	1	7.1
Stand	89	169.8

Table 3. Average radial growth rates (years inch⁻¹) for selected canopy trees. Trees cored at breast height.

Species	Mean radial growth, years inch ⁻¹ (individual growth rates)
<u>Abies concolor</u>	14.6 (16.8, 11.2, 8.3, 8.0, 8.6, 26.4, 23.2)
<u>Picea breweriana</u>	21.1 (20.2, 13.5, 44.4, 25.6, 11.3, 32.0, 15.8, 16.6, 10.4, 21.0)
<u>Abies procera</u>	11.8 (11.8)
<u>Pseudotsuga menziesii</u>	15.5 (15.5)
<u>Pinus lambertiana</u>	16.4 (16.4)

PRESTON PEAK QUADRANGLE
CALIFORNIA-OREGON
15 MINUTE SERIES (TOPOGRAPHIC)

JOSEPHINE CO

123°30'

OREGON

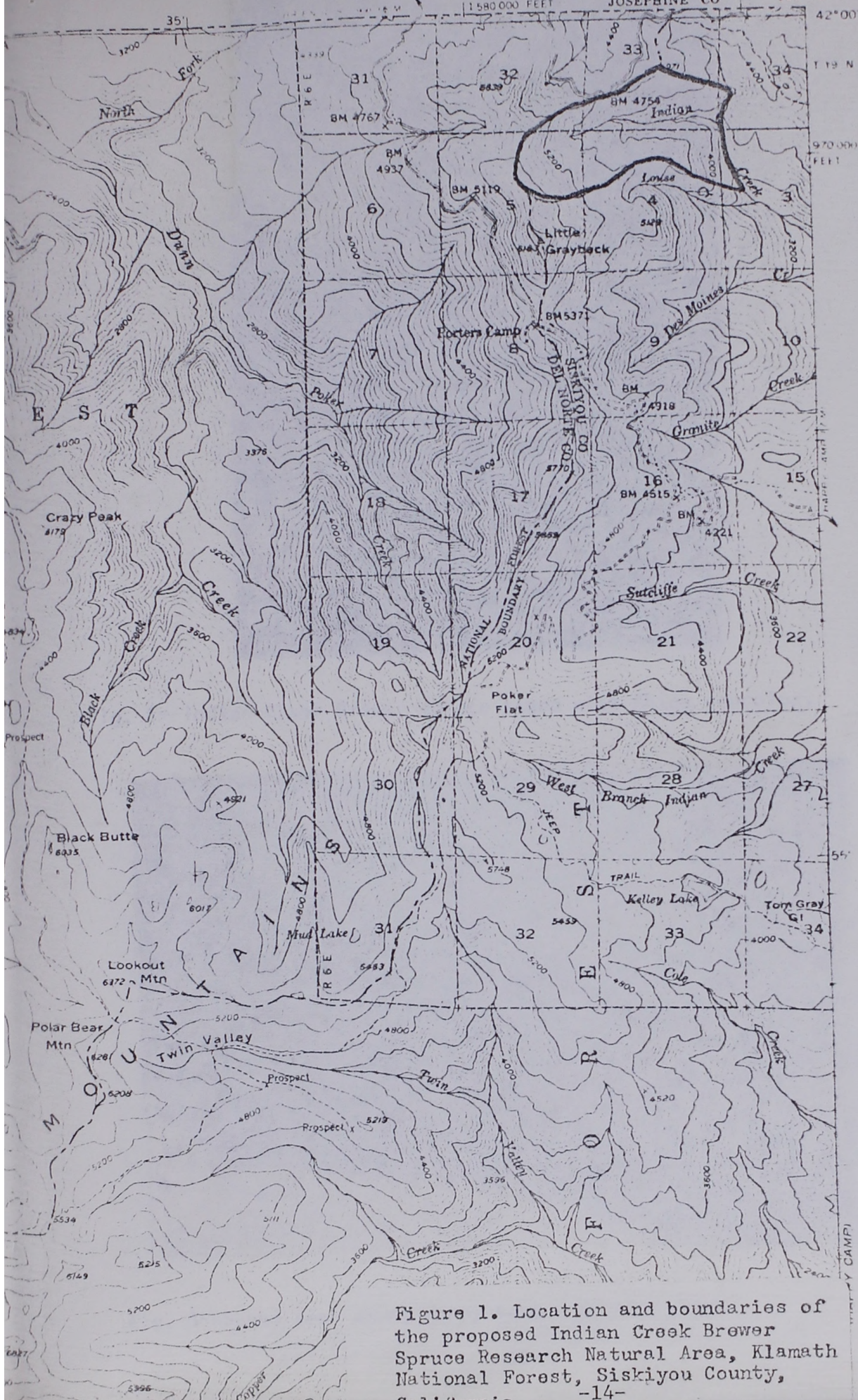


Figure 1. Location and boundaries of the proposed Indian Creek Brewer Spruce Research Natural Area, Klamath National Forest, Siskiyou County, California.



Fig. 2--Indian Creek Brewer spruce stand with Abies concolor.



Fig. 3--Stand seen along Happy Camp - O'Brien Road.



Fig. 4--Typical all-aged clump of Picea breweriana.



Fig. 5--Clearcut dominated by Arctostaphylos patula and Quercus sadleriana in south part of proposed RNA.

Appendix I. Taxa recognized within the proposed Indian Creek Brewer Spruce Research Natural Area. Collected plants were identified using the facilities of the Humboldt State University Herbarium (HSC). Vouchers are deposited there. Nomenclature follows P. Munz. 1959. A California flora. Univ. Calif. Press, Berkeley. 1581 p. unless authorship is given.

Aceraceae

Acer glabrum var. torreyi
Acer macrophyllum

Aristolochiaceae

Asarum caudatum

Berberidaceae

Mahonia nervosa Nutt.

Betulaceae

Alnus sinuata
Corylus cornuta var. californica

Campanulaceae

Campanula prenanthoides
Campanula scouleri

Caprifoliaceae

Linnaea borealis ssp. longiflora
Lonicera ciliosa
Lonicera conjugialis
Sambucus microbotrys
Symphoricarpos hesperius

Celastraceae

Paxistima myrsinites

Compositae

Arnica mollis
Hieracium albiflorum
Hieracium cynoglossoides

Appendix I. Continued

Cornaceae

Cornus nuttallii
Cornus stolonifera

Crassulaceae

Sedum obtusatum

Cupressaceae

Calocedrus decurrens (Torr.) Florin
Chamaecyparis lawsoniana

Ericaceae

Arctostaphylos nevadensis
Arctostaphylos patula
Vaccinium coccinium Piper

Fagaceae

Chrysolepis chrysophylla (Dougl. ex Hook.) Hjelmquist
Quercus garryana var. breweri
Quercus sadleriana

Fumariaceae

Dicentra formosa

Garryaceae

Garrya fremontii

Gramineae

Agrostis exarata
Bromus vulgaris
Calamagrostis koelerioides
Dactylis glomerata
Elymus glaucus
Melica subulata

Appendix I. Continued

Grossulariaceae

Ribes lacustre

Ribes lobbii

Ribes sanguineum var. sanguineum

Hydrangeaceae

Whipplea modesta

Hydrophyllaceae

Hydrophyllum occidentale

Juncaceae

Luzula comosa

Juncus parryi

Labiatae

Stachys mexicana Benth.

Leguminosae

Melilotus albus

Liliaceae

Clintonia uniflora

Disporum hookeri var. trachyandrum

Lilium washingtonianum

Trillium ovatum Pursh. ssp. ottingeri Munz and Thorne

Trillium ovatum ssp. ovatum

Smilacina racemosa var. amplexicaulis

Smilacina stellata

Onagraceae

Circaea alpina var. pacifica

Epilobium brevistylum

Orchidaceae

Corallorhiza striata

Goodyera oblongifolia

Appendix I. Continued

Pinaceae

Abies concolor

Abies procera

Picea breweriana

Pinus lambertiana

Pseudotsuga menziesii

Podophyllaceae

Achlys triphylla

Vancouveria hexandra

Polygonaceae

Eriogonum nudum

Polypodiaceae

Athyrium felix-femina

Chielanthes gracillima

Polystichum imbricans (D. C. Eat.) Wagner

Primulaceae

Trientalis latifolia

Pyrolaceae

Chimaphila menziesii

Chimaphila umbellata var. occidentalis

Pyrola picta

Pyrola secunda

Ranunculaceae

Anemone deltoidea

Rhamnaceae

Ceanothus velutinus

Rosaceae

Amelanchier alnifolia Nutt. var. florida (Lindl.) Schneider
Fragaria californica
Prunus emarginata
Rosa gymnocarpa
Rubus lasiococcus
Rubus leucodermis
Rubus macropetalus
Rubus parviflorus
Sorbus californica

Rubiaceae

Galium triflorum

Salicaceae

Salix scouleriana

Saxifragaceae

Benisoniella oregana (Abrams & Bacig.) Morton
Heuchera micrantha
Mitella pentandra
Tellima grandiflora
Tolmiea menziesii

Scrophulariaceae

Nothochelone nemorosa (Dougl.) Straw
Pedicularis howellii
Pedicularis racemosa
Penstemon anguineus
Penstemon newberryi ssp. berryi

Taxaceae

Taxus brevifolia

Umbelliferae

Osmorhiza chilensis

Violaceae

Viola glabella
Viola sempervirens